

Modelling the Resilient Policy-Making Infrastructure by Using Systems-Engineering Architecture through the D-Case

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Abstract

This study is to propose the resilient policy-making infrastructure based upon the systems-engineering methodology. The concept of dependability and assurance are developed in this paper as the key elements to secure resilience in policy-making system. There has emerged co-creative and private-public-partnership (PPP) based platform to create public policy with systems-engineering methodology in Japan, particularly after the East Japan Great Earthquake in 2011. Riding on this sea-change in the public policy theory, the study constructs the conceptual framework for public policy resilience on systems-engineering architecture, by using the D-Case, a systems-engineering method to structure and visualize stakeholders' sets of agreements and their changes. This paper then qualitatively examines the reasons why the D-case driven policy architecture is effective to maintain resiliency in co-designing public policy on unexpected catastrophic disaster that may fail on-going policy in normal policy-cycle.

Keywords: resilience, systems-engineering, D-Case

1. Introduction

1.1 Purpose and Problem

This paper is to propose conceptually the resilient framework for public policy-making process by using D-Case, systems-engineering method ensuring dependability and assurance for systems such as hardware and software systems, information systems and socio-technological systems [1].

Major disruptions of social and economic activities during the recent two decades highlighted importance of the resilient economy. For example, the 9-11 Terror in September 2001, and the 3-11 East Japan Great Earthquake in March 2011, these two tragedies both broke the grounds for many US and Japanese corporate giants to augment resilience prepared for sudden supply disruptions.

The 9-11 Terror and the 3-11 Earthquake left another important lesson learned. The public policy resilience is the key to restore social and economic activities quickly after big disasters and terrors. In the United States, the Council on Competitiveness (COC) issued the report entitled 'Transform' on resilience in 2007 and recommended to integrate competitiveness and security supported by the policy resilience for maintaining US competitiveness. In Japan, the Council on Competitiveness-Nippon (COCN) established the study group on resilient economy and issued its final report in March 2012. The COCN report recommended that systems-approach should be the central for the industries to address for mega risks, and that systems-approach should be incorporated as the national strategy of Japan to integrate multifaceted resilience measures taken by the Japanese industries.

In this sense, the resilience on making public

policy responsive to disturbances is the cornerstone of all societal and economic resilience.

However, there are two challenges to realize public policy resilience. One is consistency of stakeholders' agreements. If all stakeholders had consented to implement public policy, once major external disturbances came to the community previous consent would lose authenticity to be implemented since the disturbances changes prerequisites to all conditions for that consent. Moreover, in conventional policy cycle, it is ambiguous to what extent and how much governments are delegated its power to resume or to change public policies before terrors and disasters, because there is no positive feed-back loops embedded in the conventional public policy theory to reflect changes of policy requirements on what stakeholders agreed on making a decision on certain policy.

Another challenge is the boundary of policy-making system. There emerged the trends of more residents' participations on making public policy since the 3-11 Earthquake in Japan. The more residents desired to join in the policy-making cycle, the more challenging it is for governments to draw clear line of boundary of a policy-making system.

Open system refers to the system which has the more ambiguous boundary. Thus, if the resilient policy-making infrastructure is to be established, which is one of the most urgent societal priorities in this century, we should design the dependable and open system embedded positive feed-back loops with clear evidences on stakeholders' agreements. This paper is by system-engineering approach for modeling the resilient policy-making infrastructure

with feed-back loops and evidences written by all stakeholders of the system.

1.2 Previous studies

Resilience has conceptual roots on the system theory, in particular the theory of ecological system [2]. Many previous studies uncovered multifaceted meanings of the word ‘resilience’, but in sum, resilience in the system theory generally refers to the persistence of relations within a system and ability of a system to adjust and transform the system as a whole through its self-organizational behavior against unanticipated disturbances to that system [3][4][5][6].

In this sense, resilience is emergent behavior of a system and it has two systemic characteristics; one is system’s self-organizing efforts to persistent equilibrium within that system; another is system’s dynamic adaptation and transformation against the external disturbances [7].

In the risk society to date since 1990s [8], all social systems, such as companies, governments, local residents and NPOs are systematically and systemically required to be resilient to prepare their social and economic activities against sudden disasters and disruptions [9] [10]. If they fail in resilient responses, they may suffer from huge economic and social damage. For example, there is a study that non-resilient companies averagely dropped their ROE by 33-40% compared with similar resilient companies during three years’ period after disruptions of productions [11]. Thus most of companies are developing their resilience policy from the conventional Business Continuity Plan (BCP) approach to the Business Continuity Management System (BCMS) approach, the more system thinking-based approach. In 2012 the International Standard Organization adopted BCMS its international standard as ISO22301 [12].

The main concept of resilience is emergent behavior of a system with self-organizing for persistent equilibrium in it; and dynamic adaptation and transformation to the external disturbance.

These two attributes of resilience has been widely accepted in the other research domains about resilience than the system theory and the social sciences. For instance, the American Psychological Association (APA) refers to the similar definition of resilience for individual minds with one of the system theory [13]. The mental resilience is now one of core research area for psychology, social psychology and organizational theory [14] [15] [16].

1.3 Paradigm-shift of policy-making process

Public policy is one of important foundations to ensure resilience of the society since it means preparedness for sudden disruptions of the societal functions on how governments will address to mega

disasters and social disorders. Thus policy-making system should be resilient if public policy produced from the system be kept resilient [17].

The theories of public policy-making have recently showed two dynamic sea-changes; the first current is introductions of system and design thinking in policy design [18]. The second current is participatory policy analysis. Participatory refers to multi-stakeholders’ participation designed as systemic policy platform [19]. In Japan, there has emerged co-creative and private-public-partnership (PPP) based platform to create public policy with systems-engineering methodology in Japan, particularly after the East Japan Great Earthquake in 2011 [20].

Considering these two emerging currents of system design thinking and multi-stakeholder participation in policy-making, as well as resilience as emergent behavior of a system, the resilient policy-making system is required to have three systemic characteristics; a) self-organization process of the system, b) dynamic adaptation and transformation of the system against the external disturbances; and c) participatory system design.

2. Modelling Resilient Policy Infrastructure

The resilient policy-making infrastructure have three major characteristics based upon systems-engineering methodology; a) response-cycle of four dimensions; b) self-organization for system dependability; and c) transformation of stakeholders’ requirements that can be described by D-Case.

2.1 Four-Dimensions of Policy System Response

WEF [10], Grotberg [21] and Boniwell [22] modelled three responses stages of resilience; a) Shock stage by system disruption, b) Bouncing back stage from system disturbance, and c) Lesson-learned and story-telling stage from experiences.

This paper extends this previous model by incorporating two axes of the system evaluation since resilience comes from emergent behaviors of system; functional or dysfunctional of the system functions for the vertical axis; and full equilibrant state or not equilibrant state for the horizontal state.

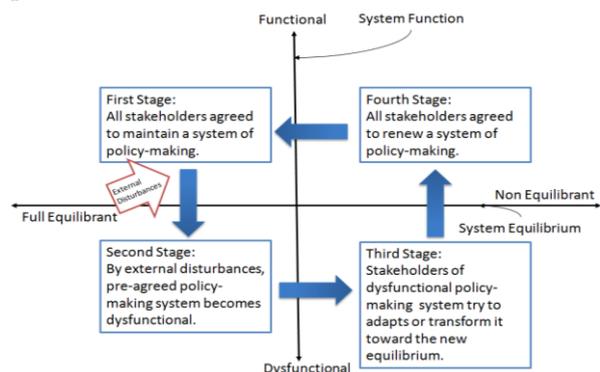


Figure 1. Four-Dimension Resilience Model

Figure 1 shows the response cycle of policy-making system hit by external disturbances.

Policy-making is defined as behavior of political system that inputs stakeholders' requirements and that outputs policy [23]. In this sense, a policy-making itself can be described as function of policy-making system [24].

On the response cycle, the system trails four dimensions. Although all stakeholders agreed policy requirements to make the system output policy on the first stage, by external disturbances the system becomes dysfunctional to perform policy creation on the second stage. Soon the system equilibrium breaks up to the third stage. Then the system operators, namely government in most cases tries to resume function of the system with stakeholders toward the fourth stage. Some of system elements start to cope with disturbances because of rehabilitation and reconstruction efforts by the system operators. This means that the system adjust or transform it-self against the external disturbances.

Consequently the system regains system functions and all stakeholders agree to renew the system elements on the fourth stage. Then the system can move to the new equilibrium. Accepting the fact that the system reached to the new equilibrium, stakeholders agreed to maintain again the system on the first stage as the new equilibrium state.

The first and second stages of this loop model corresponds to the Shock stage by system disruption of the conventional resilience stages model [10] [21] [22]; similarly the third stage to the Bouncing back stage from system disturbance, and the fourth stage to the Lesson-learned and story-telling stage from experiences.

2.2 Self-organization for system dependability

Since the resilient model of policy-making has the characteristic of self-organization, the response cycle is not the static stages model one as Laswell [25] nor Findeisen and Quade [26] described, the cycle is in the loop toward dependability enhancement.

The loop is self-organization process of policy-making system to acquire more dependability. Dependability refers to the attribute of a system that provides continuous services to users [1]. Loop for dependability enhancement of policy-making system is described in Figure 2.

This loop is different from usual life-cycle model of the dependability engineering for open systems (DEOS) because in that loop there is no development and operation stages that DEOS cycle usually have. However, since the loop enhances dependability by system's self-organization, it may be called a part of DEOS process in broad sense.

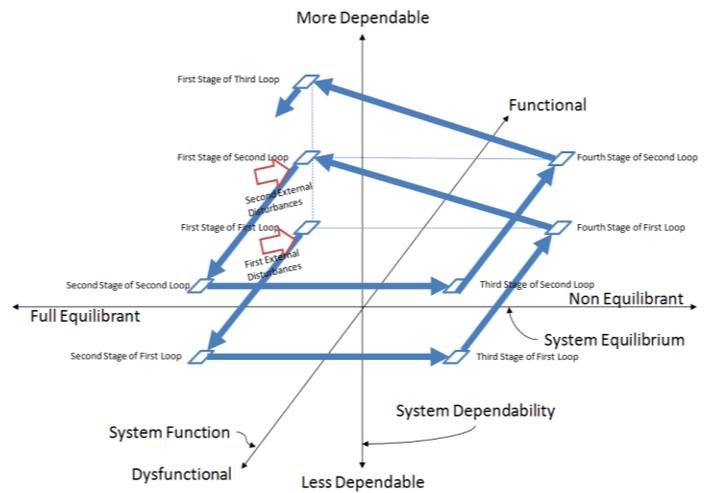


Figure 2. Loops for Dependability Enhancement

The dependability enhancement can be described as the system's learning process to acquire system assurance by self-organization.

2.3 Requirements-changes visualized by D-Case

D-Case is the method for stakeholders of system to agree on system dependability and to fulfill accountability to the society through system life-cycle [1] [27]. In this model, D-Case describes a set of requirements that all stakeholders agree for policy-making with contexts, goals, strategies, and evidences that all stakeholders participated in writing for the consent (Figure 3).

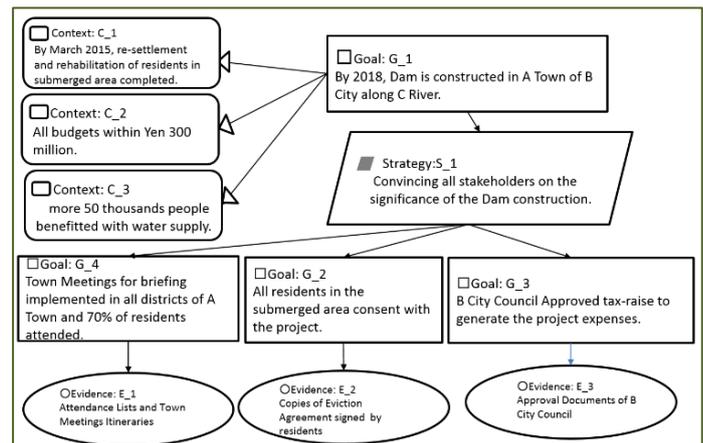


Figure 3. D-Case Example of Dam Construction Project

The more the system self-organized for dependability, the more requirements on the first stage of loops are evolving to changes. D-Case is used to visualize how much stakeholders changed their pre-agreed policy requirements. Thus D-Case performs as measurement on how the system can resiliently enhance dependability by successfully re-writing the sets of stakeholders' requirements for policy making after external disturbances (Figure 4).

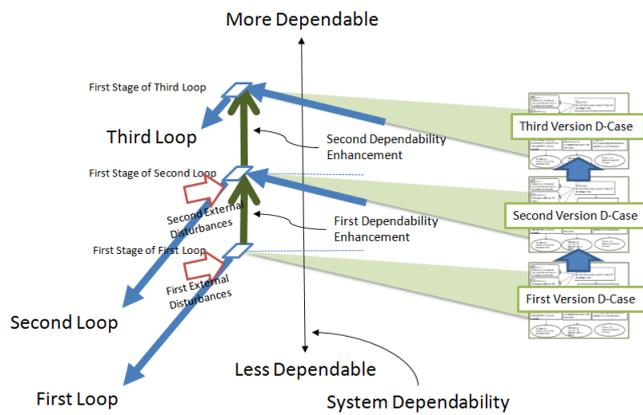


Figure 4. Evolving D-Cases For System Dependability

2.4 Workshop for Participatory Re-writing

Workshop is defined as the place and opportunity for interactive learning process among small groups [28]. Workshop has been increasingly used for social designers to let local residents to solve their perplexed social problems since 1990s [29]. The workshops theoretically backed by the deliberative democracy [30] and the consensus conference [31] are some methods of workshop to solve social problems.

Since November 2012, the author has been implementing residents-participatory workshops as the Workshop-based Policy platform for Public-Private Partnership (WP5) Model in more than 20 cities and towns in Japan based upon system design thinking to co-create public policy in participatory manner [18].

The WP5 workshop can be a suitable platform to write or to rewrite together for local stakeholders evolving versions of D-Cases which represents evidences upon what they agreed for making certain policy (Figure 5).



Figure 5. Example of WP5 Workshop (Photo by the author on May 15, 2015 at Nagano City, Japan)

3. Discussion

Since the 3-11 Earthquake some of local governments in Japan have started the projects to re-legislate their local residents' autonomy basic ordinances (*Jyumin-Jichi Kihon-Jyorei*) toward more participatory and evidence-based legislations for policy-making. This movement is interpreted as shifts to more resilient system-based and loop-driven policy infrastructure.

The disaster-mitigation, safety and assurance for seniors and children and local energy policy became major priorities to realize resilience in public policy.

These notable movements in Japan, accelerating after the 3-11 Earthquake, suggest that national and local governments promote in action should be better conceptually endorsed by systems-engineering approach as COCN had recommended in March 2012.

4. Conclusions and Future Research Agenda

4.1 Conclusions

This study conceptually modelled the resilient framework for public policy-making process by using D-Case. It uncovered that resilience comes from self-organization process of a system, and thus emergent behavior of system should be the foundation of the policy-making system to be resilient.

This paper constructed the four-dimension model of policy resilience as transitional cycle and made it clear through D-Case that policy requirements agreed by all stakeholders are re-written after the cycle for its self-organization to ensure resilience of policy-making system.

4.2 Future research agenda

This paper dealt with the concept of resilience about policy-making system, since it inherited rich traditions of policy cycle models in the discipline of public policy analysis. The author will apply this model to actual policy-making cases for evaluating its efficacy.

Furthermore, this study will aim to generalize this concept which can be applied to other resilience studies including system-design of large social infrastructure systems or system-design of individual minds for mindfulness. It is also expected to develop to the more practicable model with D-Case in the private sector to ensure its assurance.

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